Hon H. Patterson

BULLETIN No. 88.

THE UNIVERSITY OF NEBRASKA

BULLETIN

OF THE

AGRICULTURAL EXPERIMENT STATION

OF

NEBRASKA.

VOLUME XVII, ARTICLE IV.

APPLE SCAB AND CEDAR RUST.

BY R. A. EMERSON.

DISTRIBUTED MAY 9, 1904.

LINCOLN, NEBRASKA,
U. S. A.

AGRICULTURAL EXPERIMENT STATION

OF

NEBRASKA

THE GOVERNING BOARD

(THE REGENTS OF THE UNIVERSITY)

JOHN L. TEETERS, *President*, Lincoln
EDSON P. RICH, Omaha
ELISHA C. CALKINS, Kearney
CARL J. ERNST, Omaha
CHAS. S. ALLEN, Lincoln
WM. G. WHITMORE, Valley

THE STATION OFFICERS

E. A. BURNETT, B. Sc., *Director*
T. L. LYON, Ph. D., *Associate Director and Agriculturist*
J. S. DALES, M. Ph., *Financial Secretary*
WM. W. MARSHALL, *Executive Clerk*

THE WORKING STAFF

H. R. SMITH, B. Sc., *Animal Husbandman*
A. T. PETERS, D. V. M., *Animal Pathologist*
CHARLES E. BESSEY, Ph. D., *Botanist*
S. AVERY, Ph. D., *Chemist*
A. L. HASKINS, B. Sc. A., *Dairy Husbandman*
LAWRENCE BRUNER, B. Sc., *Entomologist*
EDWIN H. BARBOUR, Ph. D., *Geologist*
R. A. EMERSON, B. Sc., *Horticulturist*
O. V. P. STOUT, C. E., *Irrigation Engineer*
G. D. SWEZEY, M. A., *Meteorologist*
J. H. GAIN, M. D. C., *Associate Animal Pathologist*
W. P. SNYDER, M. S., *Superintendent Experimental Substation, North Platte*
S. W. PAUL, *Farm Foreman*

APPLE SCAB AND CEDAR RUST.

BY E. A. EMERSON.

INTRODUCTION.

During the past three years two fungous diseases of the apple, scab and cedar rust, have been unusually prevalent in eastern Nebraska. Of the two, rust has attracted the more attention, owing to the fact that the trees attacked by it are often defoliated and thereby seriously weakened, if not killed. The further fact that the rust seriously injures cedar trees has brought it to the attention of many who would not otherwise have been concerned about it. Scab, on the other hand, becomes noticeable only by disfiguring the fruit of certain varieties of apples. As a matter of fact, scab is more injurious than is often apparent. It not only attacks the fruit but also injures the foliage to such an extent that the fruit is sometimes undersized. Moreover, the scab very commonly reduces the yield of fruit by attacking the flowers or very young fruits, causing them to drop early. This is of course a more serious trouble in "off years" than in seasons when there is a heavy set of fruit. For instance, after the freeze of 1903, which came while the trees were in bloom, there was a very noticeable difference in the amount of fruit set on sprayed and unsprayed apples, in favor of the sprayed trees.

The observations recorded in this bulletin are mainly the results of tests of spraying as a preventive of the diseases under consideration. The tests of spraying against apple scab can hardly be said to be experimental. They are more in the nature of demonstrations. Although spraying for apple scab is in reality beyond the experimental stage, tests

of the sort reported here are of considerable value, since Nebraska fruit growers and farmers have not been uniformly successful in their attempts to hold scab in check by spraying. As regards cedar rust, the work is largely experimental, comparatively few attempts having been made before to control it by spraying.

HOW THE DISEASES WORK.

Before passing to the consideration of the spraying tests, it is well to understand something of what the diseases are and how they work. Descriptions of the fungi concerned and detailed accounts of their life histories are rather for the plant pathologist to undertake than for the horticulturist. Nothing of the sort will therefore be attempted in this account.

FIG. 1. Leaves of Ralls Genet apple showing apple scab.

FIG. 2. Winesap and Red June apples showing apple scab.

Let it be said at the start that "cedar apples," which are seen so commonly on cedar trees in spring, have no relation whatever to apple scab but do have a very close relation to the rust on apple leaves. Many fungi have two or more stages of growth. One stage of apple scab occurs on the foliage, fruit, and twigs of apple trees during summer and the other on the dead apple leaves in winter and spring. Fig. 1 indicates something of the appearance of scab on the leaves in summer and fig. 2 shows how scabby fruits look. At first the scab shows as a brownish discoloration in spots on the underside of the leaves, on the flower or fruit stems, and on the young fruits. Later the upper surface of the leaves shows the disease, appearing as if swollen in spots (see fig. 1). The affected fruits often present many small, grayish-brown spots of scab and usually a few large patches of a similar color. The larger scabs often crack open (see fig. 2). If the fruits are badly affected while quite small,

they frequently drop before they have grown appreciably. Infection takes place in spring or early summer from the leaves of the preceding year's growth. Later the disease spreads from the parts first affected to the new growth.

In like manner cedar rust has two stages of growth. One stage occurs on the foliage, twigs, and fruits of the apple in summer, where it appears at first as definite yellowish spots, very unlike the rather indefinite brownish spots caused by scab. On susceptible varieties the spots increase in size as the season advances, often running together to form large patches. By midsummer the affected parts of twigs and fruits and the lower surfaces of leaves show short thread-like growths. On some less susceptible varieties, however, the diseased spots remain small and undeveloped throughout the summer. The foliage of apples is generally much more seriously injured by the rust than the fruit is. Apparently only the most susceptible varieties suffer from diseased twigs. Figs. 3, 4, and 5 give some idea of how the disease appears on the leaves, twigs, and fruits of apples. The other stage of the rust occurs, not on the apple, but on the foliage and twigs of cedar trees, where it appears during fall and winter as small, brown knots, commonly called "cedar ap-

FIG. 3. Leaves of the Wealthy apple, showing cedar rust.

FIG. 4. Twig and leaves of hybrid Prairie Crab apple showing cedar rust.

FIG. 5. Jonathan apple showing cedar rust on the fruits.

ples" (see fig. 6, No. 1). With the warm weather of spring, these knots produce threadlike tubes (fig. 6, Nos. 2 and 3), which when wet with rain grow out into large gelatinous

FIG. 6. "Cedar apples" on cedar twigs. No. 1, winter stage of cedar rust; Nos. 2, 3, and 4, spring stages of cedar rust.

tongues of an orange-yellow color (fig. 6, No. 4). About this time spores are carried by the wind to apple trees, where in turn they produce the summer stage of the rust. Spores from the summer stage on the apple infect the cedar trees again during late summer and autumn.

RESISTANCE TO RUST AND SCAB.

Varieties of apples differ widely in their susceptibility to rust and scab. While a considerable number of our common varieties of apples are not very seriously injured by scab, few of them are perfectly free from its attacks. Varieties like Ben Davis are commonly regarded as so resistant to scab that it does not pay to spray them. They are, nevertheless, far from being perfectly free from scab. From the behavior of young trees in the Experiment Station orchards, Oldenburg, Whitney, Wealthy, Salome, and Patten Greening might be said to be almost perfectly free from scab. The writer has had no experience with old trees of some of these varieties. From the same standpoint, Red Astrachan, Windsor, Jonathan, Ingram, York Imperial, Ben Davis, Gano, Northwestern, Missouri Pippin, Iowa Blush, and Grimes Golden might be called fairly resistant to scab, while Winesap, Mammoth Black Twig, Sheriff, Ralls Genet, Virginia Beauty, Red June, and Northern Spy would be regarded as very susceptible to scab.

From publications of other Experiment Stations, notably Alabama and Delaware, from reports received from a few fruit growers in this State, and from personal observation, the writer has prepared the following provisional list of apples commonly grown in Nebraska, arranged with reference to their resistance to rust. Some of these varieties may have to be changed upon further observation, and it is certainly desirable to add to the list:

Varieties Resistant to Rust.	*Varieties Susceptible to Rust.*
Cooper Early	Red June
Oldenburg	Wealthy
Early Harvest	Whitney
Sweet June	Iowa Blush
Yellow Transparent	Jonathan
Red Astrachan	Missouri Pippin
Maiden Blush	Grimes Golden[1]
Ben Davis	Prairie Crab and its relatives and hybrids.
Gano	
Winesap	
Mammoth Black Twig	
Ralls Genet	
Northwestern	
York Imperial	
Grimes Golden[1]	

REMOVING CED R TREES AS A PREVENTIVE OF RUST

No less than fifteen Experiment Stations have discussed cedar rust in their reports. Ten of them recommend to remove the cedar trees or at least to destroy the cedar apples, and some suggest destroying the affected parts of the apple trees. A number of reports suggest spraying with some fungicide, like Bordeaux mixture. A few results of practical tests of spraying have been reported, some fairly successful, some unsuccessful. One of these is of particular interest. In 1890 the Vermont Experiment Station[2] sprayed an apple tree the limbs of which interlocked with a badly diseased cedar tree, a second tree near by having been left without spraying, as a check. The sprayed tree had as many diseased leaves as the unsprayed one, but the individual leaves were less seriously affected and remained on the tree longer, so that the tree ripened some fruit, while

[1] Grimes Golden is reported as being susceptible to rust, but trees on the Experiment Station grounds have shown none of the disease.

[2] Vt. Agr. Exp. Sta. Rpt. 1890, pp. 139, 140; 1891, p. 133; 1892, pp. 83, 84.

the unsprayed tree lost both leaves and fruit. The test was repeated in 1891 with about the same results. The following winter all cedar trees in the orchard and for a mile on all sides were destroyed, with the result that in 1892 not a single tree was rusted in the whole orchard, where for some years before most of the trees had been badly affected. Where the removal of cedar trees can be accomplished without difficulty, it is perhaps the best method to follow, but in many cases the orchardist does not control all the cedar trees in the vicinity of his orchard, and, moreover, in some parts of Nebraska the cedar trees are as valuable as the apple trees. In such cases something else must be done if we wish to grow the varieties that are susceptible to the rust—and some of our most desirable sorts are very susceptible.

PLAN OF SPRAYING TESTS.

In the spraying tests against apple scab and cedar rust, six varieties of apples were used, namely, Ralls Genet, Maiden Blush, Winesap, Sweet June, Jonathan, and Wealthy. Of these, only the last two are troubled with rust, while all of them except Wealthy are usually injured by scab. The Wealthy, Sweet June, and Winesap trees used in the tests were young, the first two being five years old and the last one eight years old. The Ralls Genet, Jonathan, and Maiden Blush were old trees standing in a neglected orchard. Of the rust-susceptible varieties, the Jonathan trees stood over a quarter of a mile from the nearest cedar trees that showed any rust. The Wealthy trees were in two blocks, one on low land close to and almost surrounded by cedar trees badly affected by rust, and the other on high land somewhat farther from cedar trees.

In all the tests the spray mixture used was liquid Bordeaux of the ordinary strength, about four pounds of copper sulphate and four pounds of quicklime to fifty gallons of water (see directions for preparing Bordeaux mixture, page

19). The spraying was very thorough in every case. The first spraying was given April 26 and 27, soon after the apple leaf buds had begun to expand and when the characteristic tubes had begun to break from the brown knots on the cedar trees. This spraying included Jonathan, Wealthy, Sweet June, and Ralls Genet. The second spraying, including the same varieties, followed on May 7 and 9, about twelve days after the first, when the apple flowers were beginning to open. The rainy weather of about this time had caused the cedar apples to enlarge rapidly and to assume the characteristic orange color and gelatinous character. The third spraying came sixteen days after the second, or May 23, in case of Jonathan and Ralls Genet, and nineteen days after the second spraying, May 28, for the Wealthy and Sweet June. Maiden Blush and Winesap trees were now sprayed for the first and only time, May 23 for the former and May 27 for the latter. At the time of this last spraying the blossoms had fallen from most varieties of apple. No trace of scab was yet seen. The cedar apples were apparently still in a condition to give off rust spores. No rust was visible on either the sprayed or unsprayed Wealthy or Jonathan trees, though rust spots were showing plainly on the leaves of the prairie crab and prairie crab hybrids in the same vicinity.

To determine the amount of cedar rust on sprayed and unsprayed trees, 100 leaves were picked at random from the various trees and afterwards examined for rust spots, the number of rusted leaves and the total number of rust spots being noted. This was done in the latter part of July. The prevalence of scab on the sprayed and unsprayed trees was determined approximately at about the same time by simply examining from 100 to 200 fruits per tree. Later when the apples were picked, all the fruits except in case of Jonathan were examined and the amount of scab on different trees determined more accurately. The fruits were put into two classes, "scabby" and "not scabby," the former if they had

any large spots of scab or several small ones, the latter if they were free from scab or showed only a few small spots of it.

RESULTS OF SPRAYING FOR RUST.

The results of the season's work against cedar rust on apple trees are given in the following table:

TABLE I.—*Effect of spraying on cedar rust.*

Tree No.	Variety.	No. of sprayings.	Dates of spraying.	Per cent of leaves rusted.	Total number of rust spots.	Average number of rust spots per rusted leaf.
1, 2	Wealthy[1]	0	....	30	43	1.4
3, 4	"	2	Apr. 27, ... May 28	19	31	1.6
5, 6	"	2	Apr. 27, May 9, ...	12	20	1.7
7, 8	"	2	..... May 9, May 28	4	4	1.0
9, 10	"	3	Apr. 27, May 9, May 28	4	4	1.0
11–13	Wealthy[2]	0	....	77	260	3.4
14–16	"	1	.... May 28	48	97	2.0
17–19	"	2	..... May 9, May 28	9	18	2.0
20–22	"	3	Apr. 27, May 9, May 28	6	9	1.5
23	Jonathan	0	....	48	115	2.4
24	"	0	....	46	106	2.3
25	"	1	Apr. 26, ...	42	104	2.5
26	"	1	.... May 23	45	120	2.7
27	"	2	Apr. 26, ... May 23	43	110	2.6
28	"	2	Apr. 26, ... May 23	45	112	2.5
29	"	2	..... May 7, May 23	7	11	1.6
30	"	3	Apr. 26, May 7, May 23	10	15	1.5

[1] Some distance from cedar trees.
[2] Close to diseased cedar trees.

From the above table it will be seen that a tree sprayed late in April and not again sprayed showed practically as much rust as unsprayed trees. Moreover, trees given the three sprayings were, as a rule, no freer from rust than trees which received only the two later sprayings. This indicates that the early spraying had little, almost no, effect in keeping the foliage of apple trees free from rust. The third spraying, late in May, gave somewhat better results than the first spraying, though it came too late to control the rust well. With Wealthy apples almost surrounded by cedar trees, one spraying, on May 28, reduced the number of rusted leaves by about one third and the number of rust

spots by two thirds, while in case of Jonathan apples not close to cedar trees a single spraying on May 23 did not appreciably affect the amount of rust. In fact, Jonathan trees sprayed twice, April 22 and again May 23, showed practically as much rust as unsprayed trees. The second spraying, May 7 and 9, however, gave very satisfactory results in almost every case. While it happened that no tree was given this early May spraying alone, yet practically every tree given this spraying, whether in combination with the early or the late spraying or with both, showed comparatively little rust. In fact, with the Jonathan trees the spraying of May 7 was the only one that proved to be of any particular value. Trees sprayed at this time showed an average of only thirteen rust spots per hundred leaves as against an average of 111 rust spots per hundred leaves for unsprayed trees and 112 spots for all trees sprayed at times other than May 7.

This experience is of great practical importance. The results show conclusively that spraying at the wrong time, no matter how thoroughly done, is useless, while spraying at the proper time gives excellent results. Of course it is not to be assumed from this that spraying on this particular date in early May will give the best results every year. What we should learn from this test is that we must watch the "apples" on the cedar trees and spray nonresistant varieties of apple trees thoroughly as soon as the cedar apples have begun to enlarge, become gelatinous and orange-colored, the changes which indicate that the rust spores will soon be spreading the infection broadcast.

RESULTS OF SPRAYING FOR SCAB.

The results of spraying for apple scab are shown in the following table:

TABLE II.—*Effect of spraying on apple scab.*

Tree No.	Variety.	No. of sprayings.	Dates of spraying.	No. of fruits.		Per cent of scabby fruit.
				Scabby	Not scabby	
1, 2	Winesap	0	....	248	63	80
3, 4	"	1	.... May 27	36	169	13
5	Maiden Blush..	0	....	133	71	65
6	" " ..	1	.... May 23	12	273	4
7–9	Sweet June.....	0	....	39	11	78
10–12	" "	1	..... May 9, ...	20	30	40
13–15	" "	1	.... May 28	10	40	20
16–18	" "	2	..... May 9, May 28	2	48	4
19–21	" "	3	Apr. 27, May 9, May 28	2	48	4
22	Jonathan.....	0	....	54	46	54
23	"	0	....	49	51	49
24	"	1	Apr. 26, ...	46	54	46
25	"	1	.... May 23	2	98	2
26	"	2	Apr. 26, ... May 23	0	100	0
27	"	2	Apr. 26, ... May 23	1	99	1
28	"	2	..... May 7, May 23	0	100	0
29	"	3	Apr. 26, May 7, May 23	0	100	0
30	Ralls Genet....	0	....	1185	400	75
31	" "	0	....	210	59	78
32	" "	1	Apr. 26, ...	80	25	76
33	" "	2	..... May 7, May 23	4	258	2
34	" "	2	..... May 7, May 23	13	252	5
35	" "	3	Apr. 26, May 7, May 23	16	1411	1

In the records of the tests given in the above table, two or three facts stand out with special prominence. (1) The unsprayed fruit was very scabby, running from about 50 per cent in case of Jonathan to 80 per cent with Winesap. (2) The first spraying, April 26 and 27, when the leaf buds were just opening, afforded no protection to the fruit. Trees sprayed late in April, and not sprayed afterwards, had practically as scabby fruit as unsprayed trees. (3) The third spraying, May 23 and 28, gave very good results. Winesap trees sprayed only once late in May showed only about 13 per cent of scabby fruit as against 80 per cent for unsprayed trees, and Maiden Blush only 4 per cent of scab on sprayed as against 65 per cent on unsprayed trees (see figs. 7 and 8). (4) The second spraying, May 7 and 9, while beneficial in practically all cases, was not quite so effective in controlling scab as the later spraying. (5) The best results

followed two sprayings, one early and one late in May. This is well shown in case of Sweet June, where an unsprayed tree had 78 per cent of scab, one sprayed early in May, 40 per cent, one sprayed late in May, 20 per cent, and another sprayed both early and late in May, only 4 per cent.

The failure of the early spraying to give valuable results this year may not mean that early spraying can safely be omitted other seasons. Scab was rather slow in starting last spring, which may account for the poorer results from early than from late spraying.

INJURY FROM SPRAYING.

Some of the apples, notably Jonathan, were injured considerably by the spraying of May 23. The fruit was badly russeted on one side. In the worst cases the injury took the form of one-sided development of the fruits. Whether the injury was due to an overdose of the spray, to improperly made Bordeaux, to the green arsenoid used with the Bordeaux, or to the extreme tenderness of the Jonathan fruits, it is impossible to say. Color is lent to the latter supposition by the fact that Maiden Blush, Ralls Genet, and Oldenburg, sprayed the same day and with exactly the same spray mixture, were injured very slightly, scarcely being russeted at all.

The marked effect which spraying has in lessening scab is shown more clearly by photographs than by columns of figures in tables. Figs. 7 and 8 are from photographs of sprayed and unsprayed apples shown as a part of the spraying exhibit made by the Experiment Station at the Nebraska State Fair of 1904. The difference between the sprayed and unsprayed trees shown at the Fair was so marked that some skeptical persons suggested that the poorest of the unsprayed fruit and the best of the sprayed fruit had been chosen. As a matter of fact, however, the exhibit was a perfectly fair one and showed the actual average condition of the fruit on sprayed and unsprayed trees. The specimens were taken at

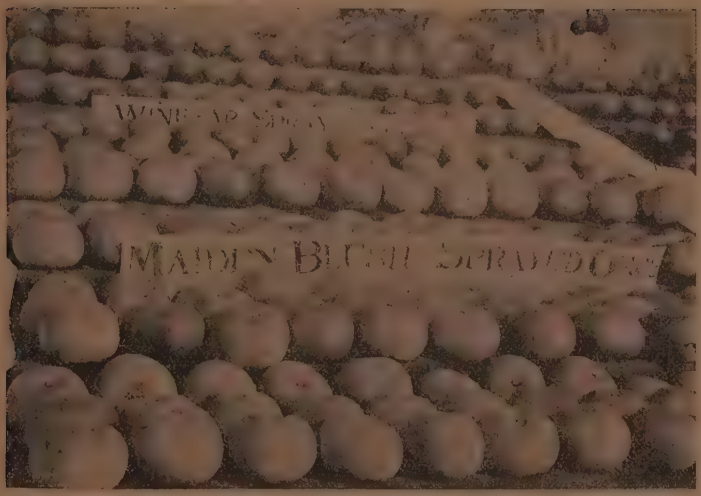

FIG. 7. Maiden Blush and Winesap apples sprayed once with Bordeaux mixture (as exhibited at the State Fair, 1904).

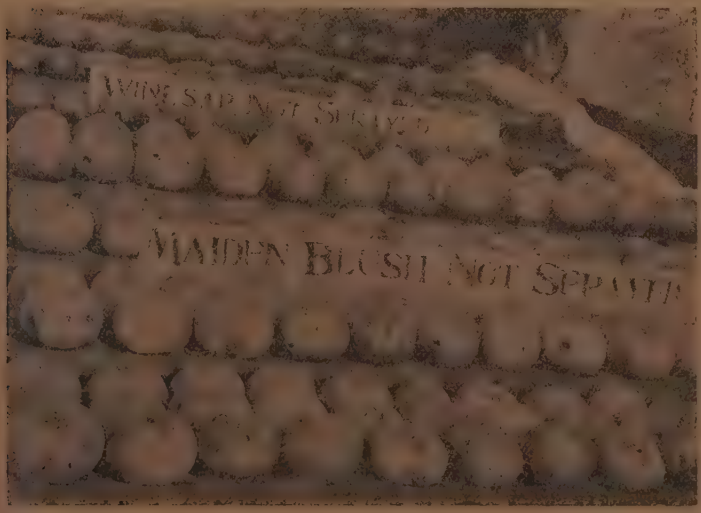

FIG. 8 Maiden Blush and Winesap apples not sprayed (as exhibited at the State Fair, 1904).

random, the only selection allowed being the throwing out of the smallest fruits from each lot. As a matter of fact, the difference between the sprayed and unsprayed fruit in the Experiment Station exhibit at the Fair was but little greater than the difference between the exhibits of the several orchardists who showed fruit for premiums. Except in case of scab-resistant varieties, one could tell at a glance whether a particular exhibit had come from a sprayed or an unsprayed orchard. If the general exhibits had been labeled, there would indeed have been little need for the spraying exhibit made by the Experiment Station.

FIG. 9. Leaves of Ralls Genet apple sprayed (on right) and unsprayed (on left).

That spraying has a beneficial effect on the foliage of apple trees as well as on the fruit can be seen from fig. 9, which shows leaves from sprayed and unsprayed trees.

PREPARATION AND USE OF BORDEAUX MIXTURE.

The character of Bordeaux mixture varies greatly, according to the way in which it is made. The following method of preparing it, now very generally employed throughout the country, has been found to give best results and should be adhered to quite rigidly. To make Bordeaux mixture, take—

4 pounds quicklime (stone lime).
4 pounds copper sulphate (blue vitriol).
50 gallons water.

Slack the lime carefully and add water to make twenty-five gallons. Dissolve the copper sulphate in water and dilute the solution to make twenty-five gallons. Mix the two solutions together by pouring first a pailful of one and then of the other into a third vessel. Never mix the solutions while warm. The lime is best slacked a day or two before being used, so that it will be perfectly cool. Strain the mixture as it is poured into the spray barrel or tank. Made in this way, Bordeaux mixture should remain in suspension in the water for some hours, but if the solutions are mixed together in concentrated form and then diluted by adding water to make up the fifty gallons or if they are mixed while hot, the resulting mixture settles very quickly, making it difficult to distribute it evenly in spraying. Bordeaux mixture should be used while fresh. After it has once settled it can never be made to stay in suspension well again. The copper sulphate solution can be kept indefinitely, and the lime will also keep well if the water is not allowed to evaporate, leaving it dry. When the two ingredients are brought together, however, the mixture should be used within a few hours at most. It is often desirable to make up stock solutions of the lime and copper sulphate in sufficient quantity to last throughout the season. When this is practiced it is common to dissolve the copper sulphate at the rate of one pound to the gallon of water and to make up the lime mix-

ture in the same way, allowing one pound of stone lime for each gallon of water. The lime and copper sulphate can then be diluted and mixed at any time, just previous to spraying.

If desired, Paris green or any other of the arsenic poisons may be added to Bordeaux mixture to kill the apple worm and other insects which may feed upon the fruit or leaves of the apple. It is especially important to add poison with the Bordeaux mixture at the second spraying for scab—soon after the blossoms have fallen. Use from one fourth to one third pound of Paris green to 50 gallons of Bordeaux mixture.

Copper sulphate solution and Bordeaux mixture should never be kept in iron receptacles, but will not injure wooden, earthen, copper, or brass vessels. The spray pump should always have brass working parts—valves, cylinders, etc.

The best spray is a fine mist. To get this it is necessary to have a good nozzle and a fairly high pressure. The tree should be sprayed until all the foliage is wet as with dew, but not until the mixture runs off from the leaves as in a rain. The spraying must be thorough. Every leaf should be hit if possible. Where whole limbs are missed, as often occurs with careless workmen, uniformly good results can not be expected. One or two sprayings carefully and thoroughly done are better than several sprayings carelessly applied, and are certainly much cheaper in both labor and material.

Bordeaux mixture adheres to foliage very well. When once it has dried onto the leaves, it is not easily washed off even by heavy rains. In the spraying tests of the past season it happened that a heavy rain fell within a day or two after almost every application of the spray, and yet the mixture was plainly visible on the foliage for two or three months after it was applied. On one occasion the spraying had to be stopped on account of a rain which came while the spray was being applied. The next day it was found necessary to renew the application in case of such trees as had

been sprayed within perhaps the last half hour before the rain. Trees sprayed earlier in the day so that the spray had dried on the leaves before the rain, did not need respraying.

CONCLUSIONS.

CEDAR RUST.

The tests here described indicate that cedar rust can be held in check, even in the case of varieties that ordinarily rust badly, by spraying the apple trees with Bordeaux mixture in spring when the apples on cedar trees are becoming gelatinous and orange-colored (fig. 6, No. 4), followed by a second spraying ten days or two weeks later. Picking and destroying the cedar apples during winter or early spring should prove of advantage but has not been tested here. The destruction of cedar trees for a distance of not less than a mile from the orchard, as is often recommended, will undoubtedly prove beneficial. This remedy, however, for various reasons can not always be employed. It is not, therefore, to be expected that this method of controlling cedar rust will be adopted except in rare cases. Spraying will probably have to be resorted to by most apple growers whose orchards are near cedar trees, unless the varieties most susceptible to rust are discarded, and it is unlikely that such varieties as Wealthy and Jonathan, for instance, will be given up soon.

APPLE SCAB.

The tests described in this bulletin indicate that apple scab can be controlled by spraying with Bordeaux mixture just before the apple blossoms open and again soon after the blossoms fall. It should be noted that during the past season the two sprayings recommended for apple scab practically coincide in time with the two sprayings for cedar rust, though the earlier of the recommended sprayings gave the better results in case of rust, and the later of the two better results in case of scab.